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Summary of the QCD and Final States in DIS and Hadron Colliders working group

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The talks given during the "QCD and Final States in DIS and Hadron Colliders" working-group sessions are summarised. The contributions included the latest precision measurements on QCD and final states from colliders experiments at TeVatron (CDF and DØ) and HERA (H1 and ZEUS) and many new results from the HERMES, COMPASS, PHENIX, Belle and BaBar experiments. The first results from LHC were also shown by the ALICE, ATLAS, CMS and LHCb Collaborations. The most recent theoretical developments were also presented; the recent developments on next-to-next-to-leading order QCD, resummation, Monte Carlo models, fits to determine the proton PDFs and new calculations of prompt-photon production were discussed.

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1. Introduction

The "QCD and Final States in DIS and Hadron Colliders" working group received a large number of requests for presentations in the different sessions. The initial agenda included 43 talks in the session of this working group alone plus 12 in joint sessions with the "Electroweak and Searches in DIS and Hadron Colliders" and "Small-x, Diffraction and Vector Mesons in DIS and Hadron Colliders" working groups. Of course, the eruption of Eyjafjallajökull changed all the plans! Fortunately, only six talks were cancelled in this working group, which gave us the opportunity to add two new contributions; four speakers who could not arrive were substituted by other willing participants who did manage to attend the workshop. All this non-physics related excitement resulted in a quite successful and lively agenda with 39+11 talks (QCD+joint sessions), only five of them delivered via Skype/EVO.

Arriving to Firenze was of course an adventure not only for the participants but also for the conveners of this working group! Claudia Glasman managed to arrive after renting a car in Hamburg and driving for two long days, Stefan Tapprogge could catch a plane two days later after several attempts and Daniel de Florian flew from Buenos Aires to Roma and then caught a train to Firenze to arrive on time. So the "QCD and Final States in DIS and Hadron Colliders" was lucky enough to enjoy the presence of its three convenors!

2. Theoretical summary

Several aspects of perturbative and non-perturbative features of QCD were discussed in the theoretical talks presented in this working group sessions, with special emphasis on higher-order corrections (up to next-to-next-to-leading order), resummation, precise extractions of the strong coupling constant, new Monte Carlo implementations and parton distributions. The main results presented are summarised in this section.

2.1 Next-to-next-to-leading order QCD

QCD corrections are usually sizeable, and therefore, indispensable to produce qualitative predictions for observables involving initial- or final-state hadrons. Next-to-leading-order (NLO) calculations for many processes became available during the last decade, involving the development of semi-authomatic methods for their computation. Moving to one higher order introduces several new complications arising from the increasing number of singular configurations. While the first computations at next-to-next-to-leading order (NNLO) for inclusive processes were performed more than 15 years ago, it is only recently that observables at this accuracy can be computed in a fully-exclusive way . During this workshop, both new calculations and developments towards a general method to compute NNLO corrections were presented.

- Giancarlo Ferrera studied the effect of NNLO corrections in the lepton-charge asymmetry for W-boson production at hadron colliders. The calculation was performed by using the q_T subtraction method developed by S. Catani and M. Grazzini. The QCD effects turn out to be small at the level of the W asymmetry, confirming the good convergence of the perturbative expansion. On the other hand, at the level of the lepton asymmetries, the QCD corrections

are larger with size and sign strongly depending on the kinematics. Furthermore, it has been shown that modern parton distribution function (PDF) sets do not provide a good description of the available data from TeVatron.

- One method to implement the subtraction of the matrix elements relies on the introduction of the "Antennae contributions", the building blocks that account for all singular configurations. The antennae terms are built in terms of physical matrix elements and depend on whether the connected partons are in the initial or final state. The corresponding contributions for the final-final configuration have been available for a while and actually used to compute the three-jet cross sections in e^+e^- collisions at NNLO. Gionata Luisoni presented the results for the initial-final antennae, derived by crossing from the final-final ones, with the complete phase-space integration and exhaustive checks in terms of existent inclusive calculations of NNLO coefficients. With these results at hand, all needed subtraction terms are available for the exclusive computation of DIS (2+1)-jets at NNLO.

- Radja Boughezal studied the case of initial-initial state antennae, essential for the subtraction of singularities in hadronic collisions. They can also be obtained from crossing of the final-final ones, but their integration turns out to be particularly complicated in the case of double-real radiation. For this configuration, a reduction based on Cutkosky rules, integration by parts and the use of algorithms to reduce phase-space integrals, results in a set of about 30 master integrals involving cut two-loop boxes with two scales. First analytical results for a set of initial-initial antennae were presented, providing an important step towards the full calculation.

2.2 Resummation

For some observables, at least under certain extreme kinematical conditions, fixed-order expansions in the strong coupling constant, α_s, are bounded to fail. Typically, the coefficient of the fixed-order expansion for a process involving two energy scales (E_1 and E_2) at order n in the coupling constant picks up contributions of the form $\log^m \frac{E_1}{E_2}$ with $m \leq 2n-1$, such that when the scales take very different values the convergence of the perturbative expansion can be spoiled. The large logarithmic contributions arise due to the restriction in the emission of soft and (eventually) collinear particles in the boundaries of phase space. To obtain a precise QCD description for such a process, the large logarithms should be *resummed* to all orders in α_s. The resummation is achieved by showing that the large logs exponentiate in a Sudakov form factor, allowing to organise a new expansion with better convergence.

- Drell-Yan provides a classic example of a process affected by such a problem at the threshold region. Marco Bonvini discussed a phenomenological analysis for Z production at the LHC. While in this case the hadronic energy is more than enough to produce the Z boson, the parton distributions force the cross section to be rather close to *partonic* threshold, such that saddle-point arguments show that the logarithms become relevant even for very low values of $x = \frac{M_Z^2}{S} \gtrsim 0.002$. A new prescription based on the Borel method was introduced, to invert from Mellin space, where the resummation is performed, to $x-$space. At variance with

the conventional "Minimal prescription" the new method introduces a cut-off that has been related to the inclusion of higher-twist terms and estimate the ambiguity of the procedure.

- Georges Grunberg discussed a way to account for the threshold logarithmic contributions beyond the eikonal approximation. The method relies on the use of a kinematically modified *à la Dokshitzer, Marchesini, Salam* physical evolution equation kernel such that the leading next-to-eikonal logarithmic contributions to the momentum space physical kernels at any loop order can be expressed in terms of the one loop cusp anomalous dimension. Analogue results hold for the fragmentation functions with hints of the possible existence of an underlying Gribov-Lipatov like relation.

- Gary Soar presented higher-order predictions for the large$-x$ behavior of the splitting kernels and coefficient functions. The $\overline{\rm MS}$ (non-diagonal) splitting and coefficient functions are found to have a double-log enhancement in $\log(1-x)$. The coefficients of the $\log^{6,5,4}(1-x)$ terms are derived at N^{3}LO accuracy. The single-log enhancement of the *physical evolution kernels* is confirmed. Work is in progress towards an extension for the prediction of the next tower of logarithms, an important step for future approximations of the fixed$-N$ moments of the N^{3}LO kernel.

- Andrea Banfi looked at the phenomenology of event-shapes in hadron collisions, defined using ratios of the transverse momenta of the final-state hadrons. Such a definition allows the reduction of the sensitivity to detector calibration and the luminosity measurement. The first resummed results at NLO+NLL predictions with a full study of theoretical uncertainties were presented. The resummation becomes essential at the boundaries of the phase space in order to make predictions for observables with a theoretical uncertainty of the order of 20%. The event-shapes turn out to be particularly useful for tuning the shower and underlying event properties in Monte Carlo codes. Furthermore, the use of jets permits to introduce event-shapes designed to discriminate topologies that increase the sensitivity on new physics searches. It was recently proposed to study jet-shape observables for one or more jets in multi-jet events leaving the others unmeasured. A. Banfi and M. Dasgupta showed that for this very complicated multi-scale problem the Soft Collinear Effective Theory (SCET) calculation by S. Ellis et al. does not correctly account for the *non-global* logarithms. Their proposal for the correct implementation in the case of well separated jets shows that the non-global logs are sizeable, of the order of $15-20\%$ at the peak of the distributions when using the anti-k_T algorithm for the jet definition.

- Giula Pancheri introduced a model in which soft gluon (k_T) resummation and infrared gluons are linked to the energy dependence of the total hadronic cross section in the very high energy limit. In this model, consistency of the energy dependence of the cross section with the Froissart bound is directly related to the infrared behavior of the coupling constant, resulting in a framework that produces phenomenological results supported by pp, $p\bar{p}$ and photoproduction data.

2.3 Monte Carlo

Monte Carlos provide an essential tool to analyse, model and understand data in high energy collisions. In this workshop, work was presented concerning the modification of Monte Carlos to include the effect of high-dense media in collisions of heavy ions and the merging between fixed-order calculations and parton showers.

- Gennaro Corcella discussed the introduction of medium-modified splitting functions in parton showers, as a way to describe energy loss in dense media heavy-ion collisions. The medium-modified kernels enhance the branching probability resulting in a strong suppression of the modified Sudakov form factor in the parton-shower algorithm. A direct implementation in HERWIG shows sizable medium-induced effects in several parton-level distributions, such as transverse momentum, angle and energy fraction. Phenomenological analyses for RHIC and LHC are in progress.

- Thomas Gerhmann presented (on behalf of Stefan Hoeche) an extension of the multi-purpose Monte Carlo event generator SHERPA to include processes in DIS. The parton shower is merged with higher-order tree-level matrix elements making possible to obtain predictions which are reliable in all kinematical limits. A very satisfactory description for a number of HERA observables, including jet cross sections, jet-transition rates and hadronic particle spectra is observed. The different sources of uncertainties due to scale choices, merging parameters, parton-shower schemes, parton distribution functions and hadronisation models were carefully quantified.

2.4 α_s

All the tools developed in order to improve the theoretical description of high-energy processes are used to extract useful information from the available data. One particular example is the obtention of a more accurate value for α_s from event shapes and jet rates in e^+e^- collisions. The recent computation of NNLO corrections for these observables makes possible now to reduce the theoretical uncertainties, from a value around ± 0.0047 at NLO accuracy, to the level of the experimental ones.

- Gionata Luisoni presented three different solid analyses of observables in order to extract $\alpha_s(M_Z)$. The first of them corresponds to the case of event-shape distributions studied at NLL+NNLO accuracy, using a Monte Carlo to perform the hadronisation corrections. The result is $\alpha_s(M_Z) = 0.1224 \pm 0.0009(\text{stat.}) \pm 0.0009(\text{exp.}) \pm 0.0012(\text{had.}) \pm 0.0035(\text{th.})$. A more accurate extraction can be obtained by studying the *moments* of the even-shape observables at NNLO accuracy. The introduction of non-perturbative corrections from a dispersive model confirms that a LO Monte Carlo underestimates the hadronisation corrections. The corresponding value for the coupling constant is $\alpha_s(M_Z) = 0.1153 \pm 0.0017(\text{exp.}) \pm 0.0023(\text{th.})$. Finally, the most precise analysis is performed to the three-jet event rate at NNLO accuracy resulting in $\alpha_s(M_Z) = 0.1175 \pm 0.002(\text{exp.}) \pm 0.0015(\text{th.})$, with a theoretical uncertainty even smaller than the experimental one.

- Vicent Mateu presented the results of a recent global fit to Thrust, based on NNLO+NNNLL(SCET) and improvements related to the treatment of non-perturbative corrections within effective field theory and renormalon subtraction. The value obtained is $\alpha_s(M_Z) = 0.1135 \pm 0.0002(\text{exp.}) \pm 0.0005(\text{had.}) \pm 0.0009(\text{th.})$, quite surprising since it is considerably lower than the result from all other event-shape analyses and with a much smaller estimate for the theoretical uncertainty.

2.5 PDFs and prompt photons

- Pedro Jimenez Delgado analysed dimuon-data, as a way to determine the asymmetry in the strange quark sector $s(x) - \bar{s}(x)$. The data was fitted using a dynamical approach, starting with valence like distributions at a low scale with the structure at higher Q^2 appearing radiatively. Allowing for an asymmetry at the initial scale results in a improvement of the dimuon data. The best fit value of $\int_0^1 dx\, x(s(x) - \bar{s}(x)) = 0.0008 \pm 0.0005$, along with other QED and non-perturbative mass effects removes the NuTeV anomaly.

- Nikolay Zotov presented a phenomenological description of prompt photon data at HERA in the k_T factorization approach. The model is based on off-shell matrix elements and unintegrated quark densities. Results for inclusive production show a good agreement with HERA data, while the model fails to reproduce the data from ZEUS in the case of associated production with jets. The H1 and ZEUS Collaborations showed their measurements compared to these predictions (see below).

3. Experimental summary

Tests of (non-)perturbative QCD via hadronic final states at colliders or fixed-target experiments is one of the most active areas of research, as demonstrated by the 27 experimental talks presented during the sessions of this working group. Tests of perturbative QCD (pQCD), comparison of non-perturbative models with data, fragmentation effects, baryon and meson spectroscopy, search for exotic particles, study of the photon structure and nuclear matter are some of the topics discussed during the workshop. A brief discussion of some selected experimental results is presented in this section. Further details can be found in the individual contributions to these proceedings.

3.1 QCD @ work: from e^+e^- to eN to μd to heavy ions

Different features of QCD were studied in a variety of processes, from the simplest e^+e^- collisions and growing in complexity of the reaction to e beams on light and heavy nuclei to μd scattering and, finally, to heavy-ion interactions.

- The **BaBar Collaboration** (speaker: F. Anulli) measured two-photon interactions in single-tag mode in the processes $\gamma\gamma^* \to \pi^0,\ \eta_c$ to study the quasi-real photon form factor. The cross section for π^0 or η_c production as a function of Q^2, the virtual photon momentum transfer, is proportional to the form factor. Fits using different approaches, such as a monopole fit or leading-order (LO) pQCD, give information on the free parameters of the models.

- The **Belle Collaboration** (speaker: F. Anulli) measured the processes $\gamma\gamma \to \pi^0\pi^0,\ \eta\pi^0$ in the no-tag mode. The angular distributions were measured in the high-mass region, with $W > 2.5$ GeV. Perturbative QCD predicts a $\sin^{-4}\theta^*$ behaviour for the cross section; however, a non-negligible contribution from a term $\cos^2\theta^*$ was measured for W values up to ~ 3 GeV.

- The **HERMES Collaboration** (speaker: K. Rith for I. Lehmann) presented their new results on nuclear-medium effects in hadronisation. Rates of π, K and p in Ne, Kr and Xe as functions of ν, Q^2, z and p_t^2 were presented. Over one hundred dependencies were extracted from these rates by studying the distributions as a function of one variable in slices of the others. Even though single-differential distributions showed no surprises, some of the double-differential rates showed quite an unexpected behaviour, which is not possible to understand with the currently available models.

- The **HERMES Collaboration** (speaker: K. Rith) presented new results on transverse Λ polarisation in unpolarised quasi-real photoproduction, via the process $eA \to \Lambda^{\uparrow}X$. The Λ polarisation was measured for different nuclei: it was found to be positive for light nuclei and consistent with zero for heavy nuclei; also the value of the polarisation for hydrogen was measured to be much larger than for deuterium. The sign of the value obtained is opposite to that obtained for pion and proton beams and the same as for $K^-(us)$ and $\Sigma^-(dds)$ beams. The origin of these effects could be interpreted as coming from the s-quark content of the γ^*.

- The **COMPASS Collaboration** (N. Rossiyskaya) presented comparisons of yields of hyperons and anti-hyperons in deep inelastic scattering (DIS). The relative yields $R^+ = \Sigma^+/\Lambda$, $\bar{R}^- = \bar{\Sigma}^-/\bar{\Lambda}$, $R^- = \Sigma^-/\Lambda$ and $\bar{R}^+ = \bar{\Sigma}^+/\bar{\Lambda}$ were measured and found to be independent of Q^2. The measurements also show that the relative yields of Λ and $\bar{\Lambda}$ are similar.

- The **PHENIX Collaboration** (speaker: M. Nguyen) presented their latest results on medium modification to jet production with fully reconstructed jets and with fragments from direct γ triggered (recoil) jets. A large suppression of the yields in central $Au+Au$ interactions was observed at a level consistent with previous studies of single and di-hadron production. The new measurements have the advantage that they do not suffer from biases that make the previous results of high-p_T single and di-hadron suppression difficult to interpret. Furthermore, the new measurements constitute a strong constraint on the theory.

3.2 Challenging pQCD to the extreme

The most stringent tests of pQCD are achieved presently at the ep HERA collider and in $p\bar{p}$ collisions at TeVatron. HERA provides well understood hadronic-induced reactions with a large centre-of-mass energy and a large level-arm in Q^2. Measurements of different processes at TeVatron give access to the highest energy accessible so far. The new measurements presented by the experiments contribute to a continuing understanding of QCD and to an improvement of the determination of the PDFs, which are both crucial to understand physics at LHC.

- The **CDF Collaboration** (speaker: N. Moggi) presented new studies of the underlying event in hadron-hadron collisions using the Drell-Yan process: $p\bar{p} \to \gamma^*/Z^0 \to e^+e^-$ or $\mu^+\mu^-$. The underlying event was defined as all the particles produced in the event, except for the

lepton pair. In this way, the Drell-Yan processes provide a clean probe of the underlying event. Observables sensitive to the underlying event, such as the charged-particle density, were studied and compared to similar studies done in jet events. Three regions were defined in azimuthal angle (transverse to the beam direction): the "toward" (in the γ^*/Z^0 direction), "away" (in the direction opposite to the γ^*/Z^0) and two "transverse" (transverse to the direction of the γ^*/Z^0) regions. It was found that the "transverse" regions are most sensitive to the details of the underlying event. It is also observed that the underlying-event observables are constant with lepton-pair P_T in this region. There is an adequate agreement between the Drell-Yan and jet results for $P_T > 50$ GeV.

- The **H1 Collaboration** (speaker: A. Grebenyuk) measured distributions of transverse momentum for charged particles at low Q^2. The measured distributions present a high sensitivity to models based on different evolution of parton dynamics (DGLAP vs. BFKL evolution) and to hadronisation parameters, especially at low P_T.

- The **H1 Collaboration** (speaker: K. Daum for J. Ruiz Tabasco) presented results for the production mechanism of K_s^0 mesons at high Q^2. These constitute the first measurements of such production at high Q^2. It was found that the dominant production mechanism is hadronisation and that the data are well described by the Monte Carlo with a strange fraction of $\lambda_s = 0.286$, in agreement with the observations at LEP.

- The **ZEUS** (speaker: K. Olkiewicz) and **H1 Collaborations** (speaker: G. Grindhammer for D. Traynor) tested the fragmentation functions by measuring the scaled momentum distributions for charged particles. The comparison of results from the ep collider HERA and from e^+e^- data from LEP indicate a universal behaviour of the fragmentation functions. The H1 Collaboration presented distributions for negative- and positively charged particles separately for the first time. The data from ZEUS and H1 are very precise and have the potential to constrain the fragmentation functions.

- The **ZEUS** and **H1 Collaborations** (speaker: T. Haas for D. Saxon) presented measurements of prompt-photon production. The comparison of the measurements of prompt-photon+jet production in photoproduction from H1 shows that the theoretical calculations cannot describe all the measured cross sections simultaneously in the whole measured range. The theoretical calculations also fail to describe the measurements of inclusive prompt-photon production in DIS at low Q^2 and low x. Calculations in the k_T factorisation approach seem to describe the data better.

- The **DØ Collaboration** (speaker: L. Sawyer) presented first measurements of di-photon direct production, which test pQCD largely unaffected by hadronisation effects. Di-photon production constitutes a major background to $H \to \gamma\gamma$. The comparison between the data and different Monte Carlo models shows that none of the theoretical predictions describes the data simultaneously in the whole measured range.

- The **CDF Collaboration** (speaker: S. Moed) presented new results on $W + c-$jet production. This channel is dominated by $s - g$ fusion and so the measurements are sensitive to the V_{cs}

matrix element and the g/s PDFs at $\mu_R = M_W$. In this way, measurements at TeVatron test the universality of the *s*PDF and its evolution. This channel constitutes a background to top, Higgs and stop production and to the search for new physics in hadron colliders. The new precise measurement of the production cross section are consistent with the NLO prediction and can help to constrain further the theory.

- The **DØ Collaboration** (speaker: Z. Hubacek) measured dijet cross sections at high invariant mass values. Dijet cross sections provide the highest reach in energy and probe hard interactions at the shortest distance with small experimental uncertainties. Thus, these measurements are ideal to test the Standard Model (SM) and search for new physics. In addition, measurements as functions of angular correlations are directly sensitive to the underlying dynamics. The measurements of the dijet cross sections as functions of the angular correlation in different regions of dijet invariant mass, from 0.25 to above 1.1 TeV, are well described by NLO QCD calculations; no significant deviation was observed and so limits on several models beyond the SM were obtained. The cross sections as functions of the invariant mass in different regions of rapidity have the potential to constrain the proton PDFs.

- The **DØ Collaboration** (speaker: L. Sawyer) presented first measurements of three-jet production at TeVatron. The measurements include the three-jet invariant mass cross sections in different regions of rapidity. The comparison with NLO QCD calculations shows a reasonable agreement.

- The **DØ Collaboration** (speaker: L. Sonnenschein) presented a determination of α_s from inclusive-jet cross sections. The extracted energy-scale dependence of the coupling is in good agreement with the predicted running of α_s and with the measurements from ZEUS and H1, at lower scales. The value of $\alpha_s(M_Z)$ obtained is the most precise from a hadron-hadron collider.

- The **H1 Collaboration** (speaker: R. Kogler) presented new measurements of multi-jet cross sections at low Q^2. The measurements have high statistics and small experimental uncertainties. The NLO QCD calculations give a good description of the data. However, the theoretical uncertainties, dominated by terms beyond NLO, are large. The energy-scale dependence of the coupling was determined from the multi-jet cross sections. The results are in good agreement with the predicted running of α_s. The uncertainty of the extracted value of α_s is dominated by terms beyond NLO; NNLO calculations are needed to obtain a more precise determination of α_s from these measurements.

- The **ZEUS Collaboration** (speakers: D. Lontkovkyi and C. Glasman) presented new measurements of inclusive-jet cross sections in NC DIS and photoproduction. The measured cross sections are very precise, the experimental uncertainty is dominated by the uncertainty on the jet-energy scale, which has been reduced to $\pm 1\%$, and so very stringent tests of pQCD from $Q^2 \approx 0$ to 20000 GeV^2 were obtained. Theoretical uncertainties and hadronisation corrections are small. The NLO QCD calculations give a very good description of the NC DIS data in the whole measured range. The inclusive-jet cross sections in photoproduction are

well described by the NLO QCD calculations, except at low E_T^{jet} and high η^{jet}. The influence of the parameterisation of the photon PDFs and that of non-perturbative effects was investigated for these regions of phase space. Precise values of $\alpha_s(M_Z)$ and the energy-scale dependence of the coupling were obtained from the measurements in both regimes. Precise new dijet cross-section measurements at high Q^2 were also presented. These measurements are very precise and have the potential to constrain further the proton PDFs. In addition, novel tests of pQCD using different jet algorithms were also presented.

3.3 QCD @ the energy frontier: the future is already here!

The long-awaited first results from the LHCb, CMS, ALICE and ATLAS experiments at LHC were presented during this workshop. The measurements presented in the sessions of this working group include the study of particle spectra at different centre-of-mass energies and the comparison with different QCD-based Monte Carlo models. These first measurements are used to study the global characteristics of hadron collisions in a new kinematic regime and will give input to the event generators to constrain phenomenological models.

- The **LHCb Collaboration** (speaker: M. Schiller) presented distributions for prompt-K_s production as functions of P_T in different regions of rapidity at $\sqrt{s} = 900$ GeV. Different Monte Carlo tunes were compared to the data; however, none of them describe the data well simultaneously in the whole measured range.

- The **CMS Collaboration** (speaker: K. Krajczar) presented measurements of the charged-particle distributions as functions of pseudorapidity and P_T at $\sqrt{s} = 0.9$ and 2.36 TeV. The results at $\sqrt{s} = 0.9$ TeV were compared to those from ALICE and UA5 and found to be in agreement within the experimental uncertainties.

- The **ALICE Collaboration** (speaker: S. Masciocchi) presented the results of charged-particle multiplicity at $\sqrt{s} = 0.9$, 2.36 and 7 TeV. The charged-particle multiplicity dependence with $\sqrt{s}$ is observed to rise faster than the Monte Carlo predictions. A fit with a power-law dependence on energy describes the data.

- The **ATLAS Collaboration** (speaker: H. Gray) presented results at $\sqrt{s} = 0.9$ and 7 TeV of charged-particle multiplicity. The energy dependence observed by ATLAS is also steeper than the predictions. The averaged transverse momentum distribution as a function of charged-particle multiplicity was also presented and compared to different models: none of the Monte Carlo models describe the data. These measurements will be used to tune further the Monte Carlo models.

Acknowledgments

We would like to thank the organisers of the conference, specially because of their endurance during the crisis we all suffered due to the volcano eruption in Iceland. In spite of the ashes, the workshop provided a warm atmosphere that led to many lively physics discussions.